Sept. 13, 1966 A. U. BRYANT 3,272,475

FLEXIBLE GATE VALVE HAVING LOAD BEARING MEANS

Filed Feb. 8, 1963 5 Sheets-Sheet 1

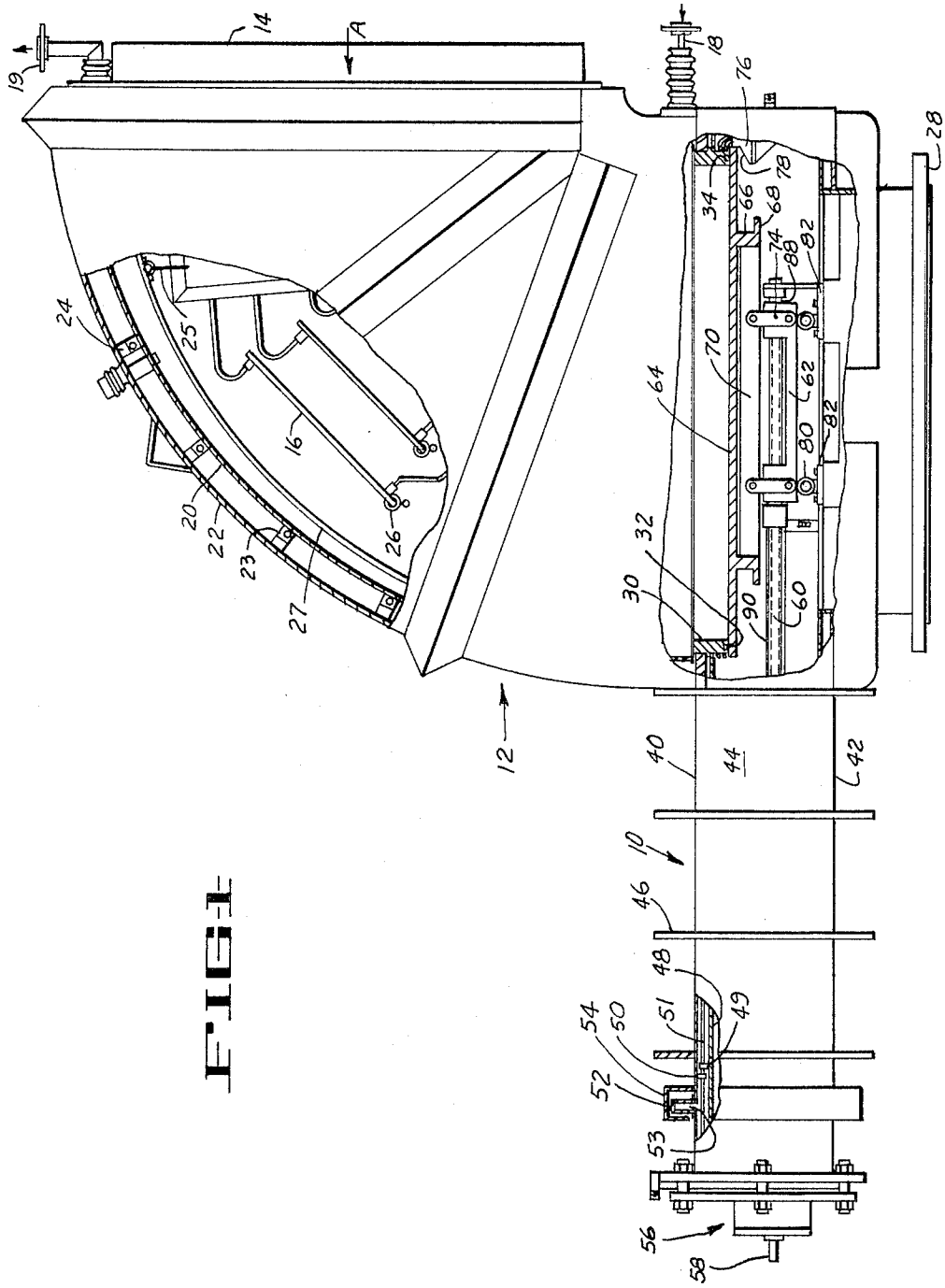



FIG. 1

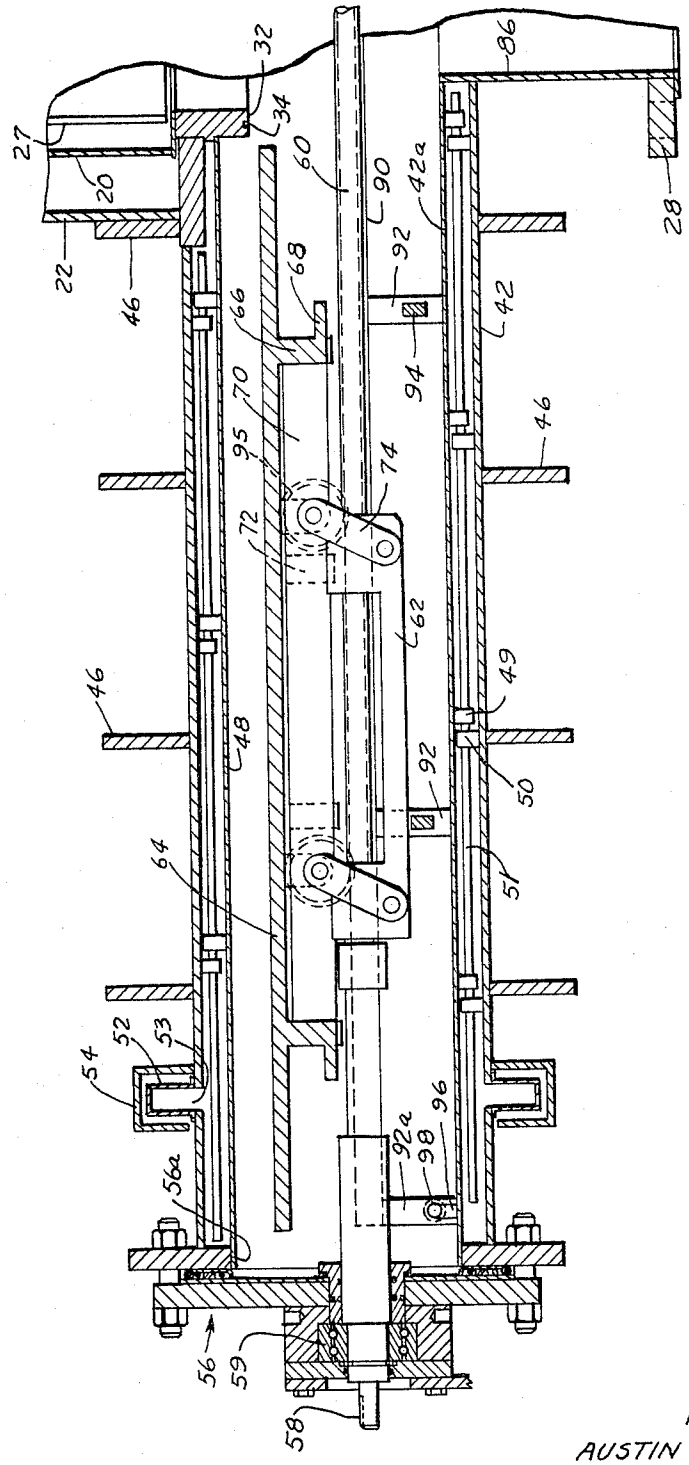
INVENTOR.
AUSTIN U. BRYANT
BY Edward B Gregg

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FLEXIBLE GATE VALVE HAVING LOAD BEARING MEANS

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FIG-2-



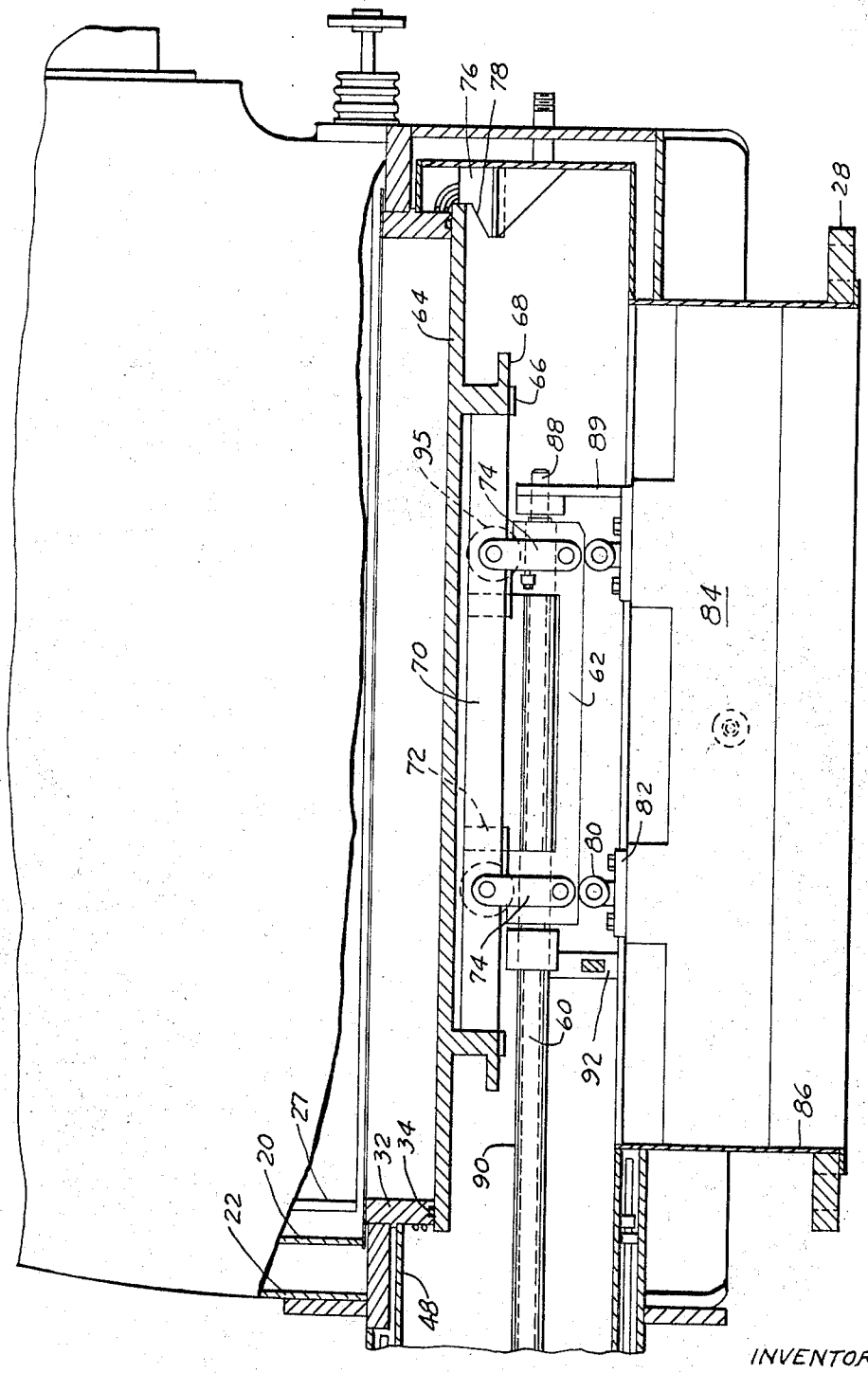

INVENTOR
AUSTIN U. BRYANT
BY Edward B. Gregg

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FLEXIBLE GATE VALVE HAVING LOAD BEARING MEANS

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FIG-3




INVENTOR
AUSTIN U. BRYANT
BY Edward B Gregg

Sept. 13, 1966 A. U. BRYANT 3,272,475

FLEXIBLE GATE VALVE HAVING LOAD BEARING MEANS

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FIG-5

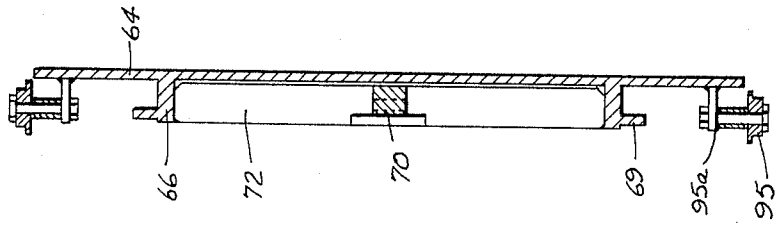
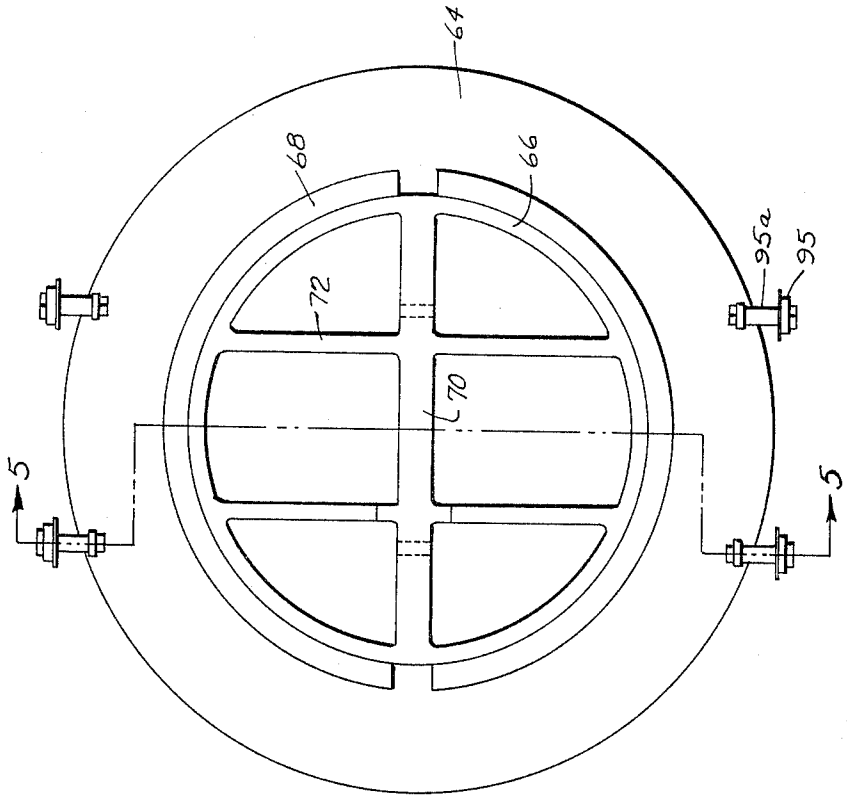



FIG-4




INVENTOR
AUSTIN U. BRYANT
BY Edward B Bugg

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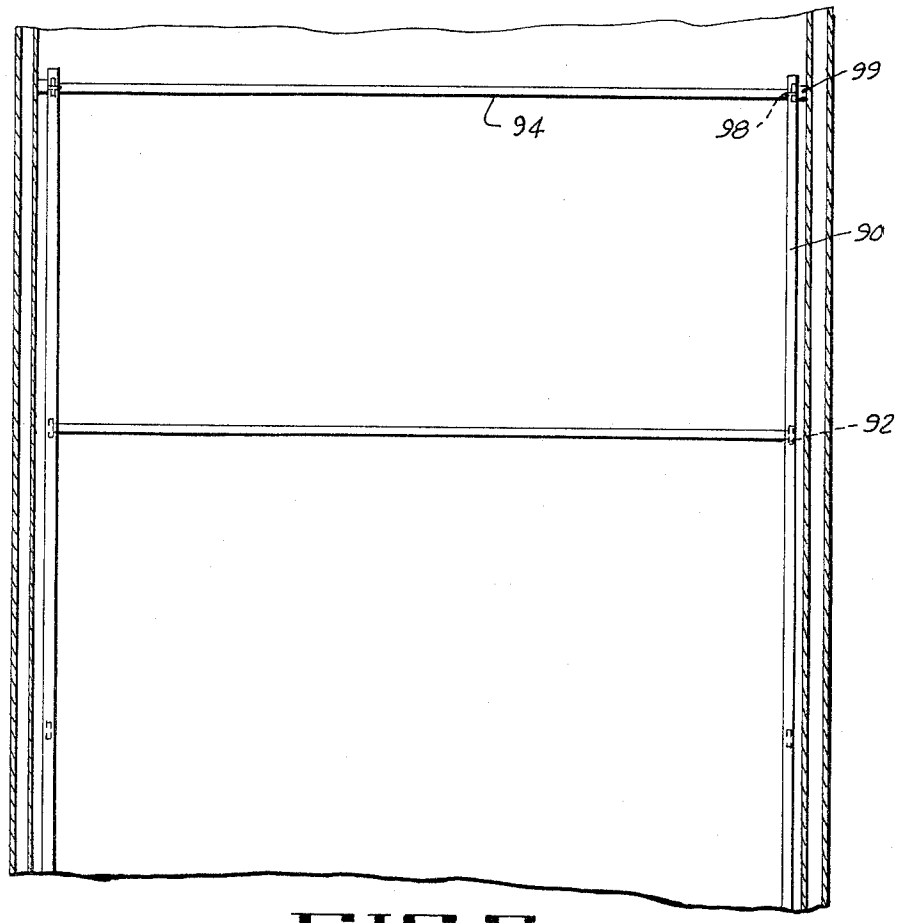



FIG-7-

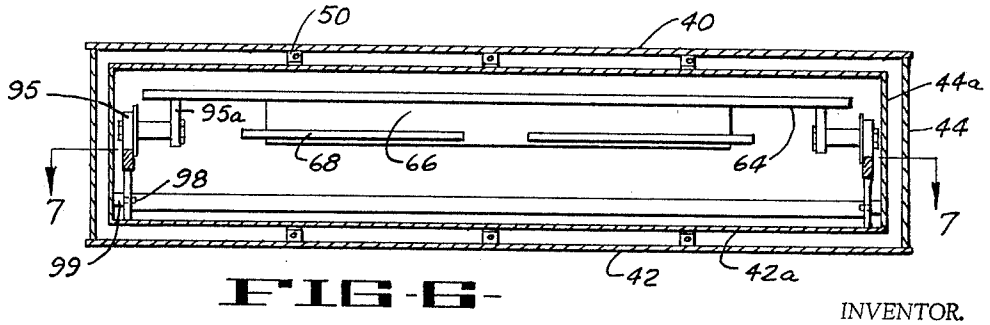



FIG-6-

INVENTOR.
AUSTIN U. BRYANT
BY Edward B Gregg

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# FLEXIBLE GATE VALVE HAVING LOAD BEARING MEANS

Austin U. Bryant, Walnut Creek, Calif., assignor to Grove Valve and Regulator Company, Oakland, Calif., a corporation of California

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5 Claims. (Cl. 251—203)

This invention relates to a gate valve and, more particularly, to a gate valve adapted to seat under mechanically induced pressure.

In certain types of gate valves, particularly where the sealing is against the flow of fluid, i.e., on the high pressure side, it is desirable to apply an extraneous force to seal the valve against the seat. However, in many cases slight irregularities around the seat or on the face of the valve itself may prevent complete sealing. In the case of a valve employed in an evacuation system, the gate may be required to seal off a conduit when a vacuum on either side is opposed by atmospheric pressure or by a vacuum of lower order.

It is, therefore, an object of this invention to provide a valve that may be moved into and out of alignment with the valve seat together with means for forcing the valve laterally against the seat.

It is a further object of this invention to provide a relatively flexible valve plate that may be forced tightly against the seat and flex into continuous sealing engagement therewith.

It is a further object of this invention to provide a flexible valve plate with means to force it against the seat by connection therewith to a load bearing member in the central portion of the valve plate.

It is a further object of this invention to provide a valve gate that is movable along a removable track to a position in alignment with the valve seat and then movable laterally into firm engagement therewith.

Other objects and advantages of this invention will become apparent from the description following when read in conjunction with the accompanying drawings wherein:

FIG. 1 is a view partly in section showing the valve of this invention installed in an evacuation system;

FIG. 2 is an enlarged partial section view showing the valve in open condition;

FIG. 3 is a partial section view showing the valve in closed condition;

FIG. 4 is a bottom view of the gate forming a feature of this invention;

FIG. 5 is a section view taken along line 5—5 of FIG. 4;

FIG. 6 is a vertical section view of the valve body showing the trackway and gate mounting; and

FIG. 7 is a horizontal section view taken along line 7—7 of FIG. 6.

Referring more particularly to FIG. 1, the valve of this invention **10** is particularly adapted for use as a vacuum valve wherein a chamber (not shown) is connected to the duct **12** at weld end **14** and evacuated in the direction of the arrow A. The duct is preferably provided with a plurality of cold baffle plates or panels **16** through which liquid nitrogen or similar cryogenic fluid is circulated from inlet pipe **18** to outlet pipe **19** in order to assist the vacuum pump by freezing and retaining certain susceptible molecules, such as oil vapor that may be back-streaming from the pump, water vapor and the like. The duct **12** is preferably of multi-walled construction having an inner and outer shell **20** and **22** connected together by rods **23** inserted through enlarged holes in aligned eye blocks **24** on the inner and outer shells. The enlarged holes provide a sliding and free movement suspension arrangement that will accommodate relative expansion and contraction occasioned by differential temperature. Preferably the baffles **16** are supported at **25** and **26** within an inner cold shell or trap **27** through which the liquid nitrogen is also circulated.



The molecules drawn through the duct **12** by a suitable vacuum pump (not shown) which may be connected at flange **28** pass through a flow passageway **30** around which is surrounded by a valve seat **32** preferably including suitable seal means **34** such as a conventional O-ring.

The valve **10** is preferably horizontally disposed and includes top and bottom walls **40** and **42** and side walls **44** all of which may be reinforced by hoop-like reinforcing ribs **46** which are welded thereto in order to prevent internal buckling. The valve body **10** is preferably of double walled construction having an inner shell **48** which is secured to the outer shell by means of eye blocks **49** and **50** secured to the inner and outer walls respectively and slidably carried on an interconnecting rod **51**. Again the rods **51** engage enlarged holes in the eye blocks that permit relative sliding and transverse movement that may be occasioned by differential thermal expansion or contraction. Additionally, the outer wall preferably includes an expansion joint **52** comprising a channel member of relatively thin metal that can be expanded and contracted laterally. The bendable channel **52** is welded across a gap **53** around the outer wall, so that the thin channel can bend to accommodate thermal expansion and contraction. The expansion joint **52** may be protected by a shield **54** which is of larger channel shape and secured to the outer wall of the valve body. At the end of the valve body is a conventional bonnet structure **56** sealing off the end and rotatably supporting a stem **58** or other suitable valve operating mechanism. Rotation of the stem in bearing **59** (FIG. 2) produces rotation of an elongated screw **60** integral therewith that threadedly receives an enlarged motion transmitting or traverse member **62** threadedly received on the screw to move therealong as the screw is rotated.

Connected to the traverse member **62** by means hereinafter to be described is the valve closure member which preferably comprises a relatively flexible circular plate **64** of a diameter slightly larger than the valve seat **32**. Secured to the under side of the valve plate **64** is a circular load bearing member or beam **66** preferably strengthened by a radial flange **68**. The circular load transmitting member **66** is reinforced by a diametrical beam **70** and cross ribs **72** all of which are welded directly to the circular load bearing member but as shown in FIG. 4 are spaced from the underside of the valve plate **64** (FIGS. 4 and 5) to permit some flexing of the central portion of the plate **64** under fluid pressures. Thus, axial loads on the beam **70** will be transmitted, not directly to the valve plate **64**, but to the bearing ring **66** which will distribute them uniformly around the valve plate. Additionally, the bearing ring is of a diameter smaller than the valve seat **32** so that axial loads transmitted thereby will force the central portion of the valve plate **64** upward causing it to flex slightly around the outside until contact around the valve seat is complete.

Referring again to FIGS. 1 to 3, the means for transmitting such axial loads will now be described. Pivotally carried on the traverse member **62** is a pair of toggle links **74** that are in turn pivotally mounted on the diametrical load transmitting beam **70**. Also provided on the end of the valve body **10** is a stop block **76** having an inclined front edge **78** that is engageable by the leading end of valve plate **64** as it moves from the open position shown in FIG. 2 to the closed position shown in FIG. 3. Then, when the valve plate **64** contacts the stop plate **76** further movement of the traverse member **62** along the thread **60** forces the lower ends of the toggle links **74** forwardly to swing the links **74** upwardly forcing the valve **64** firmly against the valve seat **32**, the action being

initially assisted by the inclined leading edge **78** of the stop plate **76**. A pair of rollers **80** mounted on brackets **82** secured to a rail or beam **84** extending across the outlet passageway **86** engages the underside of the traverse member **62** to prevent it from being forced downwardly and function as a base against which the toggle links **74** push to bring the valve plate **64** firmly against the valve seat **32**. Dimensions of the toggle links **74** and their mountings are selected so that the valve plate **64** is driven firmly against the seat causing it to flex downwardly somewhat around its periphery to adjust itself to any irregularities in the surface of the valve seat **32**. Preferably an adjustable stop lug **88** in bracket **89** is disposed in the path of the traverse member **62** to stop further longitudinal movement thereof after the toggle links have been extended the desired amount.

As an additional feature of this invention a pair of side rails **90** are supported on the inner bottom wall **42***a* on legs **92**, the rails at opposite sides of the valve body being interconnected by strengthening cross members **94** which space the rails to be traversed by flanged rollers **95** rotatably mounted in brackets **95***a* carried on the underside of the valve gate plate **64**. Thus, the gate moves freely along the rails **90** and guided therealong by the flanged rollers from the open position of FIG. 2 to the closed position of FIG. 3.

The rails **90** are merely supported on the bottom wall **42***a* of the valve body and are not secured in place so that they may be moved readily to facilitate cleaning and repairs in the interior of the valve body. The rails are positioned by inserting them through the bonnet opening **56***a* and inserting a slot **96** in the rearward pair of legs **92***a* over a pin **98** extending from a pair of lugs **99** on each side of the valve body. Thus, the pins **98** hold the legs and, hence, the track **90** in proper longitudinal position and the engagement of the lugs **99** against the sides of the legs secure them against lateral displacement.

While this invention has been described in connection with a preferred embodiment thereof, it is understood that modifications and changes therein may be made by those skilled in the art without departing from the spirit and scope of this invention which is defined by the claims appended thereto.

Having described my invention I claim:

**1.** A valve comprising:
a valve body,
a flow passageway through said valve body,
an annular valve seat surrounding said flow passageway,
a generally circular, flexible valve plate,
an annular load transmitting member of a diameter smaller than said valve seat and valve plate secured coaxially to said valve plate,
a motion transmitting member,
means connected to said motion transmitting member to produce movement thereof to carry said valve plate into and out of alignment with said valve seat, and
means connecting said motion transmitting member and said load transmitting member and operated in response to movement of said motion transmitting member when said valve plate is moved into alignment with said valve seat to urge said load transmitting member toward said valve seat and force said valve plate into firm engagement with said valve seat.



**2.** The valve defined in claim **1** wherein said load transmitting member comprises:
a ring secured to said valve plate so as to be substantially coaxial with said valve seat when said valve plate is in alignment therewith, and
at least one cross bar secured across said ring but free of said valve plate, and wherein:
the last-named means includes means connected between said motion transmitting member and said cross bar.

**3.** The valve defined by claim **2** wherein said least-named means comprises:
at least one toggle link connected between said motion transmitting member and said cross bar, and
a stop member engaged by one of said valve plate and load transmitting member when said valve plate is in alignment with said valve seat.

**4.** The valve defined by claim **3** including:
at least one roller rotatably mounted in said valve body and displaced axially from said valve seat,
said roller being engaged by said motion transmitting member while moving said valve plate into alignment with said seat to prevent movement of said motion transmitting member away from said seat but enabling it to move parallel to said seat.

**5.** A gate valve comprising:
a valve body,
a flow passageway through said body,
an annular valve seat surrounding said flow passageway,
a flexible, generally circular valve plate,
a load transmitting member including a circular member of smaller diameter than said valve plate and valve seat secured coaxially to said valve plate,
a track removably secured within said valve body and disposed generally parallel to said valve seat,
guide means on said valve plate movable along said track,
a traverse block for moving said valve plate lineally along said track from a first position displaced from said seat to a second position in alignment therewith,
a toggle link connected between said traverse block and said load transmitting member, and
a stop member engageable by said valve plate when in said second position to prevent further longitudinal movement thereof.


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WILLIAM F. O'DEA, *Primary Examiner.*
CLARENCE R. GORDON, *Examiner.*